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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT

PAPER NUMBER

1765

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/943,196	Applicant(s) MAY, CHARLES E.	
	Examiner Lynette T. Umez-Eronini	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 6-11, 13 and 21-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 6, 7, 8, 13, and 21-26 is/are rejected.
- 7) ☒ Claim(s) 9-11 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This communication is in response to Applicant's Remarks filed 12/16/2005, which were persuasive in showing claim 6 was not examined on the merits and in response to clarifying the status of the claims. Hence, a new Office Action is presented.

Claim Objections

1. Claims 7 and 13 are objected because "ammine" refers to a group of compounds, in which a metal is complexed to ammonia, i.e. copper ammine, $[\text{Cu}(\text{NH}_3)_6]$. Although each inventor is his own lexicographer, it is suggested ammine would be corrected to read, --amine--.

Claim Rejections – 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 25 and 26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 25, lines 5-6, "said volume of nonaqueous liquid" lacks antecedent basis. Appropriate correction is suggested.

Claim Rejections – 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claim 13 is rejected under 35 U.S.C. 103(a) as being obvious over Koos et al. (US 5,934,980) in view of Merchant et al. (US 6,436,860).

Koos teaches a method of planarizing a substrate by employing two separate chemical mechanical polishing (CMP) steps (column 1, lines 5-9). In step 42 (FIG. 3), a first CMP polishing solution is applied to the surface of a polishing pad to facilitate planarization of the surface **35** of substrate **12** (column 5, lines 55-59), which is followed by applying a dilution solution to the polishing pad to remove slurry of the first CMP step, and after applying the diluting solution, a second CMP solution is applied to the

polishing pad to facilitate additional planarization of the substrate (Abstract). In a preferred embodiment, the first CMP mixture includes an acidic pH with alumina particles (which is the same as applicant's aqueous slurry containing an abrasive material), (column 5, lines 55-65).

Koos teaches a second diluting solution that is applied to the polishing surface of polishing pad **16** for cleaning residual slurry (or the first CMP step) from the polishing surface of the polishing pad **16** (column 6, lines 1-5) and rotating wafer carrier **10** and the polishing table **18** continuously during the cleaning step, to enable removal of residual slurry from the substrate **12** and polishing head **27** at the same time (column 6, lines 8-10), which suggests the polishing slurry that is applied onto the polishing pad would also be disposed onto a semiconductor wafer. Koos also teaches a diluting solution is applied to the polishing surface of polishing pad **16** for clearing the residual slurry of a first CMP step (column 6, lines 1-5) as well as a second diluting solution, which comprises a solvent, such as, deionized or alternative solvents such as acetone or alcohol, (same as applicant's nonaqueous solvent), (column 8, lines 8-14). Hence, the aforementioned reads on,

A method of fabricating a semiconductor wafer, comprising:

(a) subjecting a front side of said semiconductor wafer to chemical mechanical polishing using an aqueous slurry; and

(b) disposing a volume of nonaqueous liquid including a non-aqueous solvent onto said front side of said semiconductor wafer during said chemical mechanical polishing. Since Koos uses the same method of polishing a semiconductor wafer by

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disposing an aqueous abrasive slurry onto the wafer with a polishing pad and disposing a dilution solution (same as applicants' nonaqueous liquid including a nonaqueous solvent) on a wafer for clearing residual slurry of the first CMP step from the surface of the polishing pad, then using Koos' polishing method in the same manner as claimed by applicants' would result in disposing a volume of nonaqueous liquid including a nonaqueous solvent onto said front side of said semiconductor wafer during said chemical mechanical polishing. to rinse the semiconductor wafer, **in claim 13**.

Koos differs in failing to teach said nonaqueous solvent includes an ammine.

Merchant teaches, "The CMP slurry 10 includes a first emulsion 11 having a continuous aqueous phase (AQ_E) 12 and a second emulsion 13. . . . The first emulsion 11 includes abrasive particles 18 . . . The second emulsion 13 preferably comprises an organic phase (ORG) 14 and a dispersed aqueous phase (AQ_I) 16 for capturing metal particles polished from the semiconductor wafer 20" (column 3, lines 49-60). "The organic phase 14 may comprise alcohol or iso-alcohol and preferably includes at least one complexing agent such as, from example, . . . bi-pyridine (which is an example of a nonaqueous ammine) . . ." (column 4, lines 12-19).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Koos' polishing composition by including a nonaqueous solvent such as an ammine that is taught by Merchant for the purpose of capturing metal particles polished from the semiconductor wafer (Merchant, column 3, lines 56-60).

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7. Claims 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koos (US '980) in view of Muroyama et al. (US 6,126,514) and Kobayashi (US 5,985,045).

Koos differs in failing to disclose (c) mixing said aqueous slurry containing an abrasive material and a nonaqueous solvent in a mixing unit so as to create a first volume of an aqueous slurry/nonaqueous solvent mixture with a first weight % of said nonaqueous solvent prior to being disposed onto said semiconductor wafer, in **claim 21**.

Muroyama teaches a dispersion medium for abrasive grains, used for a polishing slurry, contains at least water and a ketone based solvent may be added to the medium in order to increase the solubility of the wherein an aqueous inorganic compound of fine particles are dispersed in a nonaqueous dispersed solvent and using the slurry for polishing (column 4, line 61-column 5, line 5) Muroyama also teaches the added amount of ketone based solvent may be in a range of 0.1 to 10 vol (column 5, lines 5-7).

Kobayashi teaches a chemical-mechanical polisher that includes a container **111** of concentrated polishing fluid and a container **112** of diluent, and the components in the containers are in-line mixed to form a polishing fluid (column 53, lines 11-35), which illustrates mixing a polishing slurry and a solvent are known.

Since Muroyama mixing an aqueous polishing slurry with a nonaqueous solvent is known and Kobayashi illustrates mixing a polishing slurry and a solvent in a unit is known, then it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Koos' slurry by employing a nonaqueous solvent as

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taught by Muroyama for the purpose of using polishing slurry that polishes a variety of films such as silicon oxide, a metal oxide, metal nitride, an organic compound, and a meal film containing at least fluorine, phosphorus, arsenic and born (Muroyama, column 5, lines 13-16). Further, modifying the combination of Koos and Muroyama by mixing a polishing slurry and a solvent as taught by Kobayashi would have been obvious to one having ordinary skill in the art at the time the invention was made for the purpose better controlling over polishing since mixing occurs near the point of use that allows the polishing rate to be relatively high and less time variable than batch mixing (Kobayashi, column 6, lines 1-4).

8. Claims 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koos (US '980) in view of Tsuchiya et al. (US 5,733,177).

Koos differs in failing to teach reducing the pressure of said polishing pad, respectively on said semiconductor wafer and said front side of said semiconductor wafer prior to completing disposing a volume of nonaqueous liquid including a nonaqueous solvent onto said semiconductor wafer, **in claims 25 and 26**.

Tsuchiya teaches, "the applied pressure between the polishing pad and the wafer is simultaneously quickly decreased to reduce mechanical abrasion effects" (claim 8).

Tsuchiya illustrates reducing the pressure of a polishing pad on a semiconductor wafer is known. Hence, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Koos by using Tsuchiya's method of

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reducing the pressure of a polishing pad on a semiconductor wafer for the purpose of reducing abrasion effects (Tsuchiya, claim 8).

9. Claim 7 and is rejected under 35 U.S.C. 103(a) as being unpatentable over Koos (US '980) in view of Tsuchiya (US '177) as applied to claim 25 above, in further in view of Merchant (US '830 B1).

Koos in view of Tsuchiya differs in failing to teach said nonaqueous solvent includes an ammine.

Koos differs in failing to teach said nonaqueous solvent includes an ammine.

Merchant teaches, "The CMP slurry 10 includes a first emulsion 11 having a continuous aqueous phase (AQ_E) 12 and a second emulsion 13. . . . The first emulsion 11 includes abrasive particles 18 . . . The second emulsion 13 preferably comprises an organic phase (ORG) 14 and a dispersed aqueous phase (AQ_I) 16 for capturing metal particles polished from the semiconductor wafer 20" (column 3, lines 49-60). "The organic phase 14 may comprise alcohol or iso-alcohol and preferably includes at least one complexing agent such as, from example, . . . bi-pyridine (which is an example of a nonaqueous ammine) . . ." (column 4, lines 12-19).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Koos in view of Tsuchiya by including a nonaqueous solvent such as an ammine that is taught by Merchant for the purpose of capturing metal particles polished from the semiconductor wafer (Merchant, column 3, lines 56-60).

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9. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koos (US '980) in view of Tsuchiya (US '177) as applied to claim 25 above, and further in view of Zhou et al. (US 5,780,358').

Koos in view of Tsuchiya differs in failing to teach said nonaqueous solvent includes dimethylsulfoxide (DMSO).

Zhou teaches "Preferably, the non-aqueous coordinating solvent with the Chemical-Mechanical Polishing (CMP) slurry composition of the present invention is chosen from the group of . . . (DMSO)" (column 8, lines 1-6). "In addition to the non-aqueous coordinating solvent, . . . the abrasive powder, various other components may optionally be included within the Chemical-Mechanical Polishing (CMP) slurry composition of the present invention. These components include but are not limited to . . . aqueous and non-aqueous co-solvents . . . and the like as are know in the art to impart other desirable properties to the Chemical-Mechanical Polish (CMP) slurry composition of the present invention" (column 8, lines 40-49).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Koos in view of Tsuchiya by including DMSO to a polishing slurry, as taught by Zhou for the purpose of assisting in rapid dissolution of copper metal under mild conditions (column 7, lines 51-55).

Allowable Subject Matter

10. Claims 9, 10, and 11 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

11. The following is a statement of reasons for the indication of allowable subject matter:

As to claims 9, 10, and 11, the prior art of record, taken either alone or in combination fails to teach or suggest obvious a method of polishing a semiconductor wafer with an aqueous slurry along with a nonaqueous solvent that includes either an N,N-propanalamide, aniline, and N,N-dimethylaniline.

Response to Arguments

12. Applicant's arguments, see Remarks, filed 12/16/2005, with respect to claims 6-11, 13, and 21-26 have been fully considered and are persuasive. The objection of claim 6 has been withdrawn because the objection was in error. The rejection of claims 7, 8, 13, and 21-26 has been withdrawn because the former prior art of record failed to address newly recited limitations of the said claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 571-272-1470. The examiner is normally unavailable on the First Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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December 30, 2005

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

